

Please note:

1. All changes against R76-1 (1992) are in underlined text. ~~marked red.~~
2. Paragraphs / sentences / words that have been deleted have not been marked.
3. **Points to be clarified later are marked red with yellow background.**

INTERNATIONAL RECOMMENDATION

Working draft (WD) revision

International Recommendation

OIML R76

Non-automatic weighing instruments

Part 1: Metrological and technical requirements -Tests

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FOREWORD

The Organisation Internationale de Métrologie Légale (OIML) is a world-wide, intergovernmental organization whose main task is that of harmonizing the regulations and metrological controls applied by the national metrological services, or related organizations, of its Member States.

The main categories of OIML publications are : ...

((to be revised / updated by the BIML))

TERMINOLOGY

(terms and definitions)

The terminology used in this Recommendation conforms to the “International Vocabulary of Basic and General Terms in Metrology” (1993 edition), the “International Vocabulary of Terms in Legal Metrology” (2000 edition), the “OIML Certificate System for Measuring Instruments” (2003 edition) and other relevant OIML documents. In addition, for the purposes of this Recommendation, the following definitions apply. An index of all the terms defined below can be found under T.8.

T.1 General definitions

T.1.1 Weighing instrument

Measuring instrument that serves to determine the mass of a body by using the action of gravity on this body.

The instrument may also be used to determine other quantities, magnitudes, parameters or characteristics related to the determined mass.

According to its method of operation, a weighing instrument is classified as an automatic or non-automatic instrument.

T.1.2 Non-automatic weighing instrument

Instrument that requires the intervention of an operator during the weighing process to determine the weighing result or to decide that it is acceptable.

Note: Determining the weighing result includes any intelligent action of the operator that affects the result, such as deciding and taking an action when an indication is stable or adjusting the weight of the weighed load. Deciding that the weighing result is acceptable means making a decision regarding the acceptance of each weighing result on observing the indication or releasing a print out . The weighing process allows the operator to take an action which influences the weighing result in the case where the weighing result is not acceptable. The necessity to give an instruction to start the weighing process or to release a load, or the function of the instrument (static, dynamic, automatic loading, automatic start of weighing, etc.) are not relevant in deciding the category of a non-automatic weighing instrument.

A non-automatic weighing instrument may be:

- graduated or non-graduated,
- self-indicating, semi-self-indicating or non-self-indicating.

Note: In this Recommendation a non-automatic weighing instrument is called an "instrument".

T.1.2.1 Graduated instrument

Instrument allowing the direct reading of the complete or partial weighing result.

T. 1.2.2 Non-graduated instrument

Instrument not fitted with a scale numbered in units of mass.

T.1.2.3 Self-indicating instrument

Instrument in which the position of equilibrium is obtained without the intervention of an operator.

T.1.2.4 Semi-self-indicating instrument

Instrument with a self-indication weighing range, in which the operator intervenes to alter the limits of this range.

T.1.2.5 Non-self-indicating instrument

Instrument in which the position of equilibrium is obtained entirely by the operator.

T.1.2.6 Electronic instrument

Instrument equipped with electronic devices.

T.1.2.7 Instrument with price scales

Instrument that indicates the price to pay by means of price charts or scales related to a range of unit prices.

T.1.2.8 Price-computing instrument

Instrument that calculates the price to pay on the basis of the indicated mass and the unit price.

T.1.2.9 Price-labelling instrument

Price-computing instrument that prints the weight value, unit price and price to pay for prepackages.

T.1.2.10 Self-service instrument

Instrument that is intended to be operated by the customer.

T.1.2.11 Mobile instrument

Non-automatic weighing instrument mounted on or incorporated into a vehicle or similar utensil that enables the instrument to be moved on wheels without other tools.

Examples: Vehicle mounted instrument, vehicle incorporated instrument, road vehicle onboard instrument, patient lifter, pallet lifter, fork lifter, wheel chair weigher, pallet weigher

T.1.2.12 Portable instrument

Non-automatic weighing instrument having a load receptor - in one or several parts - that determines the mass of road vehicles, and that can - in contrast to stationary weighbridges - be moved to other places by suitable tools.

Examples: Portable weighbridge, group of associated non-automatic axle (or wheel) load weighers

Note: This Recommendation covers only weighbridges and groups of associated non-automatic axle (or wheel) load weighers that determine the mass of a road vehicle with all axles (or wheels) being simultaneously supported by appropriate load platforms. This excludes the certification of portable instruments that calculate the total mass by summing up the partial axle (or wheel) loads determined one after the other.

T.1.3 Indications of an instrument

Value of the measurand, a measurement signal, or another quantity to be used in calculating the value of the measurand.

Note: If not explicitly mentioned terms such as "indication", "indicate", or "indicating component" do not include printing.

T.1.3.1 Primary indications

Indications, signals and symbols that are subject to requirements of this Recommendation.

T.1.3.2 Secondary indications

Indications, signals and symbols that are not primary indications.

T.2 Construction of an instrument

In this Recommendation the term "device" is used for any means by which a specific function is performed, irrespective of the physical realization, e.g. by a mechanism or a key initiating an operation; the device may be a small part or a major portion of an instrument.

T.2.1 Main devices

T.2.1.1 Load receptor

Part of the instrument intended to receive the load.

T.2.1.2 Load-transmitting device

Part of the instrument for transmitting the force produced by the load acting on the load receptor, to the load-measuring device.

T.2.1.3 Load-measuring device

Part of the instrument for measuring the mass of the load by means of an equilibrium device for balancing the force coming from the load transmitting device, and an indicating or printing device.

T.2.2 Module

Identifiable part of an instrument that performs a specific function or functions, and that can be separately evaluated according to the metrological and technical performance requirements in the relevant Recommendation. The modules of a weighing instrument are subject to specified partial error limits.

Note: Typical modules of a weighing instrument are: load cell, indicator, analogue data processing device, weighing module, price-computing point-of-sale device (POS)

T.2.2.1 Load cell

Force transducer which, after taking into account the effects of the acceleration of gravity and air buoyancy at the location of its use, measures mass by converting the measured quantity (mass) into another measured quantity (output) [Ref. R60].

T.2.2.2 Indicator

Electronic device of an instrument that performs the analogue-to-digital conversion of the output signal of the load cell, and further processes the data, and displays the weighing result in units of mass.

T.2.2.3 Analogue data processing device

Electronic device of an instrument that performs the analogue-to-digital conversion of the output signal of the load cell, and further processes the data, and supplies the weighing result in a digital format via a digital interface without displaying it.

T.2.2.4 Weighing module

An almost complete weighing instrument that comprises all mechanical and electronic devices (ie. load receptor, load-transmitting device, load cell, and analogue data processing device) but not having means to display the weighing result neither to operate the instrument.

T.2.2.5 Terminal

Digital device that has a keyboard to operate the instrument and a display to indicate the weighing results transmitted via the digital interface of a weighing module or an analogue data processing device.

T.2.2.6 Remote display

Terminal without keyboard that can be used for the primary indications or for their repetition.

T.2.3 Electronic parts

T.2.3.1 Electronic device

A device employing electronic sub-assemblies and performing a specific function. An electronic device is usually manufactured as a separate unit and can be independently tested.

Note: An electronic device, as defined above, may be a complete instrument (e.g. an instrument for direct sales to the public), a module (e.g. indicator, analogue data processing device, weighing module) or a peripheral device (eg. printer, remote display).

T.2.3.2 Electronic sub-assembly

A part of an electronic device, employing electronic components and having a recognizable function of its own.

Examples: A/D converter, display matrix

T.2.3.3 Electronic component

The smallest physical entity that uses electron or hole conduction in semi-conductors, gases or in a vacuum.

T.2.3.4 Digital device

Electronic device that only performs digital functions and provides a digitized output or display.

Examples: printer, remote display, keyboard, terminal, data storage device, personal computer

T.2.3.5 Peripheral device

A peripheral device is an additional device which repeats or further processes the weighing result and other primary indications.

Examples: printer, secondary display, keyboard, terminal, data storage device, personal computer, non-price computing point-of-sale device (POS) that receives all primary indications from the weighing instrument and prints them on a ticket

T.2.4 Indicating device (of a weighing instrument)

Part of the load measuring device on which the direct reading of the weighing result is obtained.

T.2.4.1 Indicating component

Component indicating the equilibrium and/or the result.

On an instrument with one position of equilibrium it indicates only the equilibrium (so-called zero).

On an instrument with several positions of equilibrium it indicates both the equilibrium and the result. On an electronic instrument, this is the display.

T.2.4.2 Scale mark

A line or other mark on an indicating component corresponding to a specified value of mass.

T.2.4.3 Scale base

An imaginary line through the centres of all the shortest scale marks.

T.2.5 Auxiliary indicating devices

T.2.5.1 Rider

Detachable poise of small mass that may be placed and moved either on a graduated bar integral with the beam or on the beam itself.

T.2.5.2 Device for interpolation of reading (vernier or nonius)

Device connected to the indicating element and sub-dividing the scale of an instrument, without special adjustment.

T.2.5.3 Complementary indicating device

Adjustable device by means of which it is possible to estimate, in units of mass, the value corresponding to the distance between a scale mark and the indicating component.

T.2.5.4 Indicating device with a differentiated scale division

Digital indicating device of which the last figure after the decimal sign is clearly differentiated from other figures.

T.2.6 Extended indicating device

A device temporarily changing the actual scale interval (d) to a value less than the verification scale interval (e) following a manual command.

T.2.7 Supplementary devices

T.2.7.1 Levelling device

Device for setting an instrument to its reference position.

T.2.7.2 Zero-setting device

Device for setting the indication to zero when there is no load on the load receptor.

T.2.7.2.1 Non-automatic zero-setting device

Device for setting the indication to zero by an operator.

T.2.7.2.2 Semi-automatic zero-setting device

Device for setting the indication to zero automatically following a manual command.

T.2.7.2.3 Automatic zero-setting device

Device for setting the indication to zero automatically without the intervention of an operator.

T.2.7.2.4 Initial zero-setting device

Device for setting the indication to zero automatically at the time the instrument is switched on and before it is ready for use.

T.2.7.3 Zero-tracking device

Device for maintaining the zero indication within certain limits automatically.

T.2.7.4 Tare device

Device for setting the indication to zero when a load is on the load receptor:

- without altering the weighing range for net loads (additive tare device), or
- reducing the weighing range for net loads (subtractive tare device).

It may function as:

- a non-automatic device (load balanced by an operator),
- a semi-automatic device (load balanced automatically following a single manual command),
- an automatic device (load balanced automatically without the intervention of an operator).

T.2.7.4.1 Tare-balancing device

Tare device without indication of the tare value when the instrument is loaded.

T.2.7.4.2 Tare-weighing device

Tare device that stores the tare value and is capable of indicating or printing it whether or not the instrument is loaded.

T.2.7.5 Preset tare device

Device for subtracting a preset tare value from a gross or net weight value and indicating the result of the calculation. The weighing range for net loads is reduced accordingly.

T.2.7.6 Locking device

Device for immobilizing all or part of the mechanism of an instrument.

T.2.7.7 Auxiliary verification device

Device permitting separate verification of one or more main devices of an instrument.

T.2.7.8 Selection device for load receptors and load-measuring devices

Device for attaching one or more load receptors to one or more load measuring devices, whatever intermediate load-transmitting devices are used.

T.2.7.9 Indication stabilizing device

Device for maintaining a stable indication under given conditions.

T.3 Metrological characteristics of an instrument

T.3.1 Weighing capacity

T.3.1.1 Maximum capacity (Max)

Maximum weighing capacity, not taking into account the additive tare capacity

T.3.1.2 Minimum capacity (Min)

Value of the load below which the weighing results may be subject to an excessive relative error.

T.3.1.3 Self-indication capacity

Weighing capacity within which equilibrium is obtained without the intervention of an operator.

T.3.1.4 Weighing range

Range between the minimum and maximum capacities.

T.3.1.5 Extension interval of self-indication

Value by which it is possible to extend the range of self-indication within the weighing range.

T.3.1.6 Maximum tare effect ($T = + \dots$, $T = - \dots$)

Maximum capacity of the additive tare device or the subtractive tare device.

T.3.1.7 Maximum safe load (Lim)

Maximum static load that can be carried by the instrument without permanently altering its metrological qualities.

T.3.2 Scale divisions

T.3.2.1 Scale spacing (instrument with analogue indication)

Distance between any two consecutive scale marks, measured along the scale base.

T.3.2.2 Actual scale interval (d)

Value expressed in units of mass of:

- the difference between the values corresponding to two consecutive scale marks, for analogue indication, or
- the difference between two consecutive indicated values, for digital indication.

T.3.2.3 Verification scale interval (e)

Value, expressed in units of mass, used for the classification and verification of an instrument.

T.3.2.4 Scale interval of numbering

Value of the difference between two consecutive numbered scale marks.

T.3.2.5 Number of verification scale intervals (single-interval instrument)

Quotient of the maximum capacity and the verification scale interval:

$$n = \text{Max}/e$$

T.3.2.6 Multi-interval instrument

Instrument having one weighing range which is divided into partial weighing ranges each with different scale intervals, with the weighing range determined automatically according to the load applied, both on increasing and decreasing loads.

T.3.2.7 Multiple range instrument

Instrument having two or more weighing ranges with different maximum capacities and different scale intervals for the same load receptor, each range extending from zero to its maximum capacity.

T.3.3 Reduction ratio R

The reduction ratio of a load transmitting device is:

$$R = FM/FL$$

where:

FM: force acting on the load measuring device,

FL: force acting on the load receptor.

T.3.4 Family

Identifiable group of weighing instruments or modules belonging to the same manufactured type that have the same design features and metrological principles for measurement (for example the same type of indicator, the same type of design of load cell and load transmitting device-but which may differ in some metrological and technical performance characteristics (eg. Max, Min, e, d, accuracy class, ...)). The concept of family primarily aims at reducing the test effort at type examination. It does not preclude the possibility to list more than one family in one certificate

T.4 Metrological properties of an instrument

T.4.1 Sensitivity

For a given value of the measured mass, the quotient of the change of the observed variable l and the corresponding change of the measured mass M :

$$k = \Delta l / \Delta M$$

T.4.2 Discrimination

Ability of an instrument to react to small variations of load.

The discrimination threshold, for a given load, is the value of the smallest additional load that, when gently deposited on or removed from the load receptor, causes a perceptible change in the indication.

T.4.3 Repeatability

Ability of an instrument to provide results that agree one with the other when the same load is deposited several times and in a practically identical way on the load receptor under reasonably constant test conditions.

T.4.4 Durability

Ability of an instrument to maintain its performance characteristics over a period of use.

T.4.5 Warm-up time

The time between the moment power is applied to an instrument and the moment at which the instrument is capable of complying with the requirements.

T.4.6 Final weighing value

Weighing value which is achieved if the instrument is completely in rest and balanced and there are no environmental influences or disturbances taking effect on the indication.

T.5 Indications and errors

T.5.1 Methods of indication

T.5.1.1 Balancing by weights

Value of metrologically controlled weights that balance the load (taking into account the reduction ratio of the load).

T.5.1.2 Analogue indication

Indication enabling the evaluation of the equilibrium position to a fraction of the scale interval.

T.5.1.3 Digital indication

Indication in which the scale marks are composed of a sequence of aligned figures that do not permit interpolation to fractions of the scale interval.

T.5.2 Weighing results

Note: The following definitions apply only when the indication has been zero before the load has been applied to the instrument.

T.5.2.1 Gross value (G or B)

Indication of the weight of a load on an instrument, with no tare or preset tare device in operation.

T.5.2.2 Net value (N)

Indication of the weight of a load placed on an instrument after operation of a tare device.

T.5.2.3 Tare value(T)

The weight value of a load, determined by a tare weighing device.

T.5.3 Other weight values

T.5.3.1 Preset tare value (PT)

Numerical value, representing a weight, that is introduced into the instrument.

"Introduced" includes procedures such as: keying in, recalling from a data storage, or

inserting via an interface.

T.5.3.2 Calculated net value

Value of the difference between a gross or net weight value and a preset tare value.

T.5.3.3 Calculated total weight value

Calculated sum of more than one weight value and/or calculated net value.

T.5.4 Reading

T.5.4.1 Reading by simple juxtaposition

Reading of the weighing result by simple juxtaposition of consecutive figures giving the weighing result, without the need of calculation.

T.5.4.2 Overall inaccuracy of reading

The overall inaccuracy of reading of an instrument with analogue indication is equal to the standard deviation of the same indication, the reading of which is carried out under normal conditions of use by several observers.

It is customary to make at least ten readings of the result.

T.5.4.3 Rounding error of digital indication

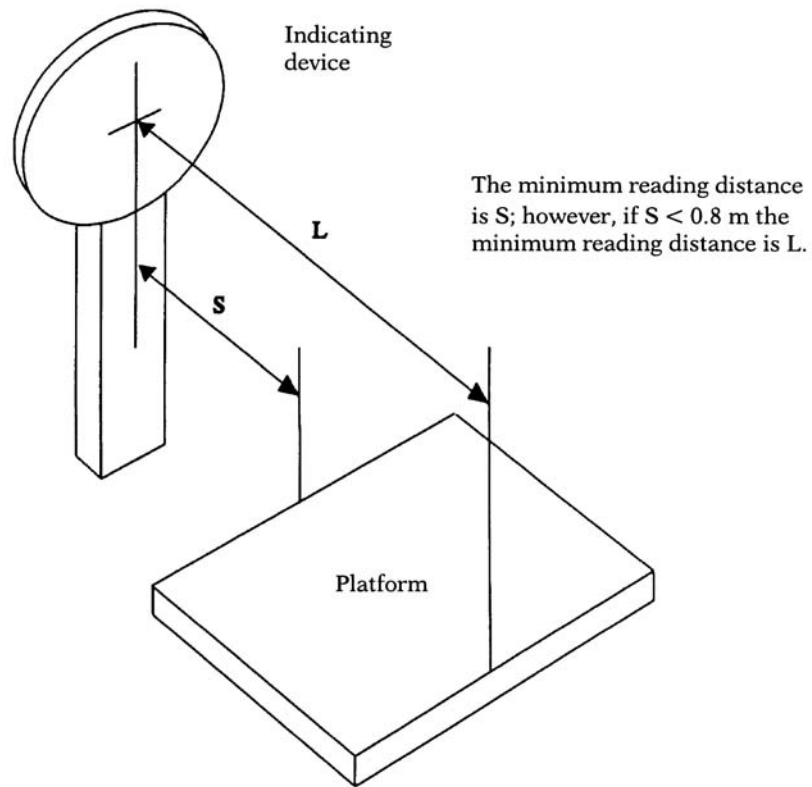
Difference between the indication and the result the instrument would give with analogue indication.

T.5.4.4 Minimum reading distance

The shortest distance that an observer is able freely to approach the indicating device to take a reading under normal conditions of use.

This approach is considered to be free for the observer if there is a clear space of at least 0.8 m in front of the indicating device (see Figure 1).

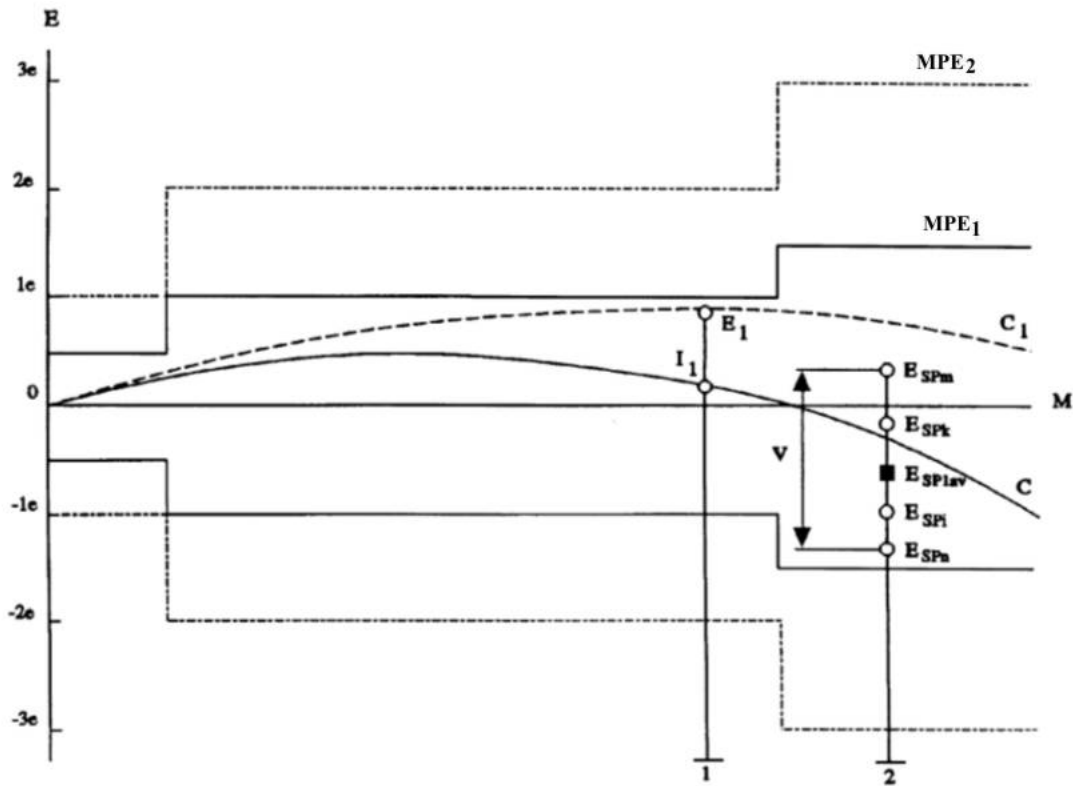
Figure 1



T.5.5 Errors

See Figure 2 for illustration of certain terms used.

Figure 2
Illustration of certain terms used



- M = mass to be measured
- E = error of indication (T.5.5.1)
- MPE₁ = maximum permissible error on initial verification
- MPE₂ = maximum permissible error in service
- C = characteristic under reference conditions
- C₁ = characteristic due to influence factor or disturbance (*)
- E_{SP} = error of indication evaluated during span stability test
- I = intrinsic error (T.5.5.2)
- V = variation in the errors of indication during span stability test

Situation 1 - shows the error E_1 of an instrument due to an influence factor or a disturbance. I_1 is the intrinsic error. The fault (T.5.5.5) due to the influence factor or disturbance applied equals $E_1 - I_1$.

Situation 2 - shows the average value E_{SP1av} of the errors at the first measurement of the span stability test, some other errors E_{SPi} and E_{SPk} , and the extreme values of the errors, E_{SPm} and E_{SPn} , all these errors being evaluated at different moments during the span stability test. The variation V in the errors of indication during the span stability test equals $E_{SPm} - E_{SPn}$.

(*) For the purposes of this illustration it is supposed that the influence factor or the disturbance has an influence on the characteristic which is not erratic.

T.5.5.1 Error (of indication)

The indication of an instrument minus the (conventional) true value of the mass.

T.5.5.2 Intrinsic error

The error of an instrument under reference conditions.

T.5.5.3 Initial intrinsic error

The intrinsic error of an instrument as determined prior to the performance and span stability tests.

T.5.5.4 Maximum permissible error

Maximum difference, positive or negative, allowed by regulation between the indication of an instrument and the corresponding true value, as determined by reference standard masses, with the instrument being at zero at no-load, in the reference position.

T.5.5.5 Fault

The difference between the error of indication and the intrinsic error of an instrument.

Note: Principally, a fault is the result of an undesired change of data contained in or flowing through an electronic instrument.

T.5.5.6 Significant fault

A fault greater than e .

Note: For a multi-interval instrument, the value of e is that appropriate to the partial weighing range.

The following are not considered to be significant faults, even when they exceed e :

- faults arising from simultaneous and mutually independent causes in the instrument,
- faults implying the impossibility to perform any measurement,
- faults being so serious that they are bound to be noticed by all those interested in the result of measurement,
- transitory faults being momentary variations in the indication which cannot be interpreted, memorized or transmitted as a measuring result.

T 5.5.7 Durability error

The difference between the intrinsic error over a period of use and the initial intrinsic error of an instrument.

T.5.5.8 Significant durability error

A durability error greater than e .

Note 1: A durability error can be due to mechanical wear and tear or due to drift and ageing of electronic parts. The concept of significant durability error applies only to electronic parts.

Note 2: For a multi-interval instrument, the value of e is that appropriate to the partial weighing range.

The following are not considered to be significant durability errors, even when they exceed e :

errors occurring after a period of instrument use that are clearly the result of a failure of a device/component, or of a disturbance and for which the indication:

- cannot be interpreted, memorized, or transmitted as a measurement result, or
- implies the impossibility to perform any measurement, or
- is so obviously wrong that it is bound to be noticed by all those interested in the result of measurement.

T.5.5.9 Span stability

The capability of an instrument to maintain the difference between the indication of weight at maximum capacity and the indication at zero over a period of use within specified limits.

T.6 Influences and reference conditions

T.6.1 Influence quantity

A quantity that is not the subject of the measurement but which influences the values of the measurand or the indication of the instrument.

T.6.1.1 Influence factor

An influence quantity having a value within the specified rated operating conditions of the instrument.

T.6.1.2 Disturbance

An influence quantity having a value within the limits specified in this Recommendation, but outside the specified rated operating conditions of the instrument.

T.6.2 Rated operating conditions

Conditions of use, giving the range of values of influence quantities for which the metrological characteristics are intended to lie within the specified maximum permissible errors.

T.6.3 Reference conditions

A set of specified values of influence factors fixed to ensure valid inter-comparison of the results of measurements.

T.6.4 Reference position

Position of the instrument at which its operation is adjusted.

T.7 Performance test

A test to verify whether the equipment under test (EUT) is capable of performing its intended functions.

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